

The seal of the State of South Dakota is a large, circular emblem in the background. It features a central illustration of a landscape with a river, a windmill, and a small town. The words "STATE OF SOUTH DAKOTA" are written in a large, serif font around the top half of the circle. Below the illustration, the year "1889" is visible. The entire seal is surrounded by a decorative, serrated border.

Statement of Basis

Title V Air Quality Permit Renewal

**Basin Electric Power Cooperative – Spirit Mound
Station**

Vermillion, South Dakota

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1.0 BACKGROUND

On March 10, 1994, Basin Electric Power Cooperative (Basin Electric) was issued a Title V air quality permit #28.0801-19 to operate two simple cycle combustion turbines at its Spirit Mound generating facility in Vermillion, South Dakota.

A renewal of the Title V operating permit was issued on March 12, 2007 and the permit expires on March 12, 2012. During the permit cycle, two administrative amendments were made to the permit to revise the responsible official. Permit condition 4.2 states that if a timely and complete application for permit renewal is submitted six months prior to the date of expiration, then the existing permit shall not expire and the conditions of that permit shall remain in effect until the Secretary takes final action on the permit renewal application. The renewal application was submitted September 1, 2011; the Department considers this to be timely and the existing permit conditions shall remain in effect.

There have been no complaints or violations filed against this facility since the last permit review.

1.1 OPERATIONAL DESCRIPTION

Basin Electric is a regional wholesale electric generation and transmission cooperative serving 120 member systems that provide power and services to 1.8 million consumers in nine states. Basin Electric's Spirit Mound Station operates two simple cycle combustion turbines to generate electricity. The station is operated on an "as needed basis" usually during periods of extreme hot or cold temperatures when electrical demands are greatest. Installation of an inlet air fogging system to increase summer generating capacity was completed in August 2000. The combined summer capacity of both units is 104 megawatts (MW). Four on-site fuel tanks with a total capacity of about eight million gallons store No. 2 distillate fuel oil. Oil is delivered to the tanks by a pipeline running adjacent to the plant site, or by truck.

1.2 Existing Equipment

Table 1-1 lists the existing equipment permitted and covered by Basin Electric's Title V air quality operating permit issued February 10, 2010.

Table 1-1 – Equipment Information

Unit	Description	Maximum Operating Rate	Control Device
#1	1975 ASEA Brown-Boveri Turbodyne Corporation combustion turbine, model No. 11-D4, equipped with a fogging device and fired with distillate oil.	830 million Btus per hour heat input	Not applicable.
#2	1975 ASEA Brown-Boveri Turbodyne Corporation combustion turbine, model No. 11-D4, equipped with a fogging device and fired with distillate oil.	830 million Btus per hour heat input	Not applicable.

The maximum designed operating rate for spring peak use is 740 MMBtus per hour heat input, and the winter peak use is 830 MMBtus per hour heat input for the combustion turbines according to the

permit application. The higher operating rate of 830 MMBtus per hour heat input will be used as the maximum operating rate.

Basin Electric identified in the application that it also operated four storage tanks. Each storage tank has a capacity of 2.1 million gallons and will store distillate oil. The Department reviewed the inspection report to determine if any additional equipment may need to be reviewed. The inspection report notes that Basin Electric operates an emergency fire pump. The Department contacted Basin on the capacity of the emergency fire pump and was informed it was constructed with the facility in 1978 and has a rated horsepower of 170. These four tanks and the fire pump will be considered during the review process.

2.0 New Source Performance Standards

DENR reviewed the following new source performance standards (NSPS) and determined the following may be applicable to the facility.

2.1 Standards Applicable to Stationary Gas Turbines

DENR reviewed the NSPS 40 CFR Part 60, Subpart GG, Standards of Performance for Stationary Gas Turbines, to determine if it is applicable to Basin Electric's operation. This NSPS is applicable if:

1. All stationary gas turbines with a heat input at peak load equal to or greater than 10.7 gigajoules (10 million Btu) per hour, based on the lower heating value of the fuel fired; and,
2. Any facility which commences construction, modification, or reconstruction after October 3, 1977.

The stationary gas turbines were constructed in 1975, prior to 1977; therefore Basin Electric is not subject to 40 CFR Part 60, Subpart GG.

2.2 Standards Applicable to Storage Tanks

There are three New Source Performance Standards for storage vessels. The three standards are applicable to the following storage vessels:

1. 40 CFR Part 60, Subpart K: applicable to storage vessels for petroleum liquids capable of storing greater than 40,000 gallons and commenced construction after June 11, 1973 but prior to May 19, 1978;
2. 40 CFR Part 60, Subpart Ka: applicable to storage vessels for petroleum liquids capable of storing greater than 40,000 gallons and commenced construction after May 18, 1978; and
3. 40 CFR Part 60, Subpart Kb: applicable to storage vessels for volatile organic liquids capable of storing 75 cubic meters (approximately 19,813 gallons) or greater and commenced construction after July 23, 1984.

The four storage tanks were constructed in March 1978 and have a capacity greater than 40,000 gallons. Therefore, 40 CFR Part 60, Subpart K may be applicable. However, this subpart applies to the storage of petroleum liquids. As defined in 40 CFR § 60.111(b), petroleum liquids do not include distillate oils, residual oils, gas turbine fuel oils, or diesel fuel oils. The distillate oil stored in the storage tanks is not considered a petroleum fuel. Therefore, this subpart and the other two subparts are not applicable.

2.3 Standards for Fire Pumps

The provisions of 40 CFR Part 60, Subpart IIII are applicable to owners and operators of stationary compression ignition (CI) internal combustion engines (ICE) that meet one of the following:

1. Manufacturers of stationary CI ICE with a displacement of less than 30 liters per cylinder where the model year is 2007 or later for engines that are not fire pump engines or model year 2008 or later for engines that are fire pump engines;
2. Owners or operators of stationary CI ICE that commence construction after July 11, 2005 where the CI ICE is manufactured after April 1, 2006 and is not a fire pump engine or manufactured as a certified National Fire Protection Association fire pump engine after July 1, 2006; or
3. Owners or operators of stationary CI ICE that modified or reconstructed their stationary CI ICE after July 11, 2005.

Basin operates a 1978 fire pump engine rated at 170 horsepower and combusts distillate oil. The fire pump engine does not meet the applicability requirements and is not applicable to this subpart.

3.0 New Source Review

ARSD 74:36:10:01 notes that new source review regulations apply to areas of the state which are designated as nonattainment pursuant to the Clean Air Act for any pollutant regulated under the Clean Air Act. Basin Electric's facility is located near Vermillion, which is in attainment for all the pollutants regulated under the Clean Air Act. Therefore, Basin Electric is not subject to new source review.

4.0 Prevention of Signification Deterioration

A prevention of significant deterioration (PSD) review applies to new major stationary sources and major modifications to existing major stationary sources in areas designated as attainment under Section 107 of the Clean Air Act for any regulated pollutant. The following is a list of regulated pollutants under the PSD program:

1. Total suspended particulate (PM);
2. Particulate with a diameter less than or equal to 10 microns (PM₁₀);
3. Particulate with a diameter less than or equal to 2.5 microns (PM_{2.5});
4. Sulfur dioxide (SO₂);

5. Nitrogen oxides (NO_x);
6. Carbon monoxide (CO);
7. Ozone – measured as volatile organic compounds (VOCs);
8. Lead;
9. Fluorides
10. Sulfuric acid mist;
11. Hydrogen sulfide;
12. Reduced sulfur compounds;
13. Total reduced sulfur; and
14. Greenhouse gases (carbon dioxide, methane, nitrous oxide, etc.).

If the source is considered one of the 28 named PSD source categories listed in Section 169 of the federal Clean Air Act, the major source threshold is 100 tons per year of any regulated pollutant. The major source threshold for all other sources is 250 tons per year of any regulated pollutant, except for greenhouse gases. Basin Electric Power Cooperative is not considered one of the 28 named PSD source categories; therefore, the major source threshold is 250 tons per year. The potential emissions of particulate matter, sulfur dioxide and nitrogen oxide are greater than the major source threshold under the PSD program.

Basin Electric's Spirit Mound facility was constructed prior to the promulgation of the PSD program in 1977 and was not required to obtain a PSD permit. However, any change that occurs at this facility must be reviewed to determine if it is considered a major modification under the PSD program.

According to the Clean Air Act, once a pollutant is regulated under any part of the Act, (as was the case with greenhouse gas emissions after the motor vehicle regulations were finalized in March 2010) major new sources or major modifications are subject to the PSD program and Title V air quality operating permit program. Under the Clean Air Act, PSD and Title V air quality operating permits are required for all sources that emit a regulated air pollutant above 100 or 250 tons per year, depending on the source. This threshold, if applied to greenhouse gases, would greatly increase the number of facilities requiring a PSD review or Title V air quality operating permit. Based on administrative necessity, the Environmental Protection Agency (EPA) increased these thresholds through the "Tailoring Rule."

On May 13, 2010, EPA issued the final version of the "Tailoring Rule" for greenhouse gas emissions. The major source threshold for greenhouse gases is listed below:

1. New PSD source because of a criteria air pollutant, the major source threshold for greenhouse gases is 75,000 tons per year of carbon dioxide equivalent or more;
2. New PSD source if greenhouse gas emissions are 100,000 tons per year of carbon dioxide equivalent or more;
3. For an existing PSD source because of a criteria air pollutant, a major modification for greenhouse gases is an increase of 75,000 tons per year of carbon dioxide equivalent or more;
4. For an existing non-PSD source that has the potential to emit 100,000 tons per year of carbon dioxide equivalent emissions or more, a major modification for greenhouse gases is an increase of 75,000 tons per year of carbon dioxide equivalent or more; and,

5. In addition to subsection (2) and (4), a specific greenhouse gas, without calculating the carbon dioxide equivalent, also needs to emit greater than 100 or 250 tons per year, whichever is applicable, to be regulated.

4.1 Emission Factors

DENR uses stack test results to determine air emissions whenever stack test data is available from the source or a similar source. When stack test results are not available, DENR relies on manufacturing data, material balance, EPA's Compilation of Air Pollutant Emission Factors (AP-42, Fifth Edition, Volume 1) document, the applicant's application, or other methods to determine potential air emissions.

4.2 Potential Uncontrolled Emissions

Potential uncontrolled emissions for each applicable pollutant are calculated from the maximum design capacity listed in the application and assuming the unit operates every hour of every day of the year. Potential uncontrolled emissions are not realistic of the actual emissions and are used only to identify which air quality permit and the requirements Basin Electric must meet.

4.3 Stationary Gas Turbines

The following emission rates for particulate matter (PM), particulate matter less than or equal to 10 microns in diameter (PM10), and nitrogen oxides are from information supplied by Basin Electric in the permit renewal application:

- PM/PM10 = 0.044 pounds/MMBtu
- Nitrogen oxide (NO_x) = 0.89 pounds/MMBtu

The following emission rates are derived from EPA's Compilation of Air Pollutant Emission Factors, also known as AP-42, Fifth Edition, Tables 3.1-1 and 3.1-2a (04/00). The sulfur dioxide emission rate is based on the sulfur content of No. 2 distillate fuel oil listed in the application (S₁ = 0.4 pounds/MMBtu).

- Carbon monoxide (CO) = 3.3×10^{-3} pounds per MMBtu
- Volatile organic compounds (VOC) = 4.1×10^{-4} pounds per MMBtu
- Sulfur dioxide (SO₂) = 1.01 x S₁ pounds per MMBtu
= 0.404 pounds per MMBtu
- Carbon dioxide (CO₂) = 157 pounds per MMBtus

AP42 did not identify an emission factor for other greenhouse gases such as nitrous oxide (N₂O) and methane (CH₄).

4.4 Potential Emissions Summary

The potential emissions are calculated assuming that the two combustion turbines operates 24 hours a day, 365 days per year (8,760 hours per year), utilizing the No. 2 distillate fuel oil. Potential uncontrolled emissions are those that would occur with no emission controls.

No control equipment is associated with the two combustion turbines; therefore, the potential uncontrolled emissions are equal to the potential controlled emissions and will be referred to as potential emissions. Equation 4.1 will be used to calculate potential emissions.

Equation 4.1 – Potential emission calculations

$$\text{Potential Emissions} = \text{Heat Input} \frac{\text{MMBtus}}{\text{hour}} \times \text{Emission Factor} \frac{\text{pounds}}{\text{MMBtu}} \times 8,760 \frac{\text{hours}}{\text{year}} \times \frac{\text{ton}}{2,000 \text{ pounds}}$$

Table 4-1 provides a summary of potential total suspended particulate matter (TSP), particulate matter less than 10 microns (PM10), sulfur dioxide (SO₂), nitrogen oxides (NO_x), volatile organic compound (VOC), carbon monoxide (CO), and carbon dioxide (CO₂ – greenhouse gases) emissions.

Table 4-1: Annual Potential Emissions

	TSP/PM10	SO₂	NO_x	VOCs	CO	CO₂
Unit	(tons/year)	(tons/year)	(tons/year)	(tons/year)	(tons/year)	(tons/year)
#1	160	1,469	3,236	1.49	12.0	570,758
#2	160	1,469	3,236	1.49	12.0	570,758
Total	320	2,938	6,472	2.98	24.0	1,141,516

5.0 National Emissions Standards for Hazardous Air Pollutants

DENR reviewed 40 CFR Part 61 to determine the applicability to this facility. Currently, there are no finalized or promulgated National Emissions Standards for Hazardous Air Pollutants standards in 40 CFR Part 61 applicable to Basin Electric.

6.0 Maximum Achievable Control Technology Standards

6.1 Major versus Area Source

The Maximum Achievable Control Technology (MACT) standards are based upon if a source is considered a major source or an area source for hazardous air pollutants. A major source of hazardous air pollutants is a facility that has the potential to emit greater than 10 tons of a single hazardous air pollutant (HAP) and/or 25 tons of any combination of HAPs. An area source has the potential to emit less than the major source threshold. DENR used EPA's AP-42, Fifth Edition, and Tables 3.1-4 and 3.1-5 to determine the HAP emission rate for distillate fuel-fired combustion turbines. The HAP emission rates can be seen in Table 6-1.

Table 6-1: Hazardous Air Pollutant Emission Factors

Compound	Emission Factor
1,3-Butadiene	1.6 E-05 pounds/MMBtu
Benzene	5.5 E-05 pounds/MMBtu
Formaldehyde	2.8 E-04 pounds/MMBtu
Naphthalene	3.5 E-05 pounds/MMBtu
PAH	4.0 E-05 pounds/MMBtu
Arsenic	< 1.1 E-05 pounds/MMBtu
Beryllium	< 3.1 E-07 pounds/MMBtu
Cadmium	4.8 E-05 pounds/MMBtu
Chromium	1.1 E-05 pounds/MMBtu
Lead	1.4 E-05 pounds/MMBtu
Manganese	7.9 E-04 pounds/MMBtu
Mercury	1.2 E-06 pounds/MMBtu
Nickle	< 4.6 E-06 pounds/MMBtu
Selenium	< 1.2 E-06 pounds/MMBtu
Total Hazardous Air Pollutants	1.307 E-03 pounds/MMBtu

Based on the emission factors above, manganese will be the single HAP emitted in the greatest amount. Using Equation 4.1, the potential HAP emissions were calculated and can be seen in Table 6-2.

Table 6-2: Potential Uncontrolled HAP Emissions

Source	HAPs	Manganese
Unit #1 (tons/year)	4.75	2.87
Unit #2 (tons/year)	4.75	2.87
Facility Total	9.5	5.7

Table 6-2 shows Basin Electric does not meet the major source threshold for HAPs or a single HAP; therefore, Basin Electric is considered an area source.

6.2 Standards for Stationary Combustion Turbines

DENR reviewed the MACT standards and determined 40 CFR Part 63 – Subpart YYYY National Emission Standards for Stationary Combustion Turbines may be applicable. This MACT Standard is applicable if the combustion turbines are located at a major source of HAP emissions. Basin Electric’s Spirit Mound facility is not located at a major source for HAPs; therefore, Basin Electric is not subject to 40 CFR Part 63 – Subpart YYYY.

6.3 Standards for Fire Pumps

40 CFR Part 63, Subpart ZZZZ establishes national emission and operating limitations for hazardous air pollutants emitted from stationary reciprocating internal combustion engines (RICE) located at major and area sources of hazardous air pollutant emissions. A stationary RICE is any internal combustion engine which uses reciprocating motion to convert heat energy into mechanical work and which is not mobile. The diesel fired fire pump is considered a stationary RICE engine.

According to 40 CFR § 63.6590(a)(1)(iii), a stationary RICE at an area source is existing (and subject to this subpart) if it commenced construction or reconstruction of the stationary RICE before June 12, 2006. This subpart states construction is defined as the date the generator was ordered.

The diesel fired fire pump was constructed prior to June 2006 and is considered an existing fire pump engine and is applicable to this subpart.

7.0 Acid Rain Program

In accordance with 40 CFR Section 72.6(b), the acid rain program is not applicable to a simple combustion turbine that commenced commercial operation before November 15, 1990. The two simple combustion turbines at Basin Electric's Spirit Mound facility commenced commercial operation before November 15, 1990. Therefore, the units are not considered an affected unit and are not subject to the Acid Rain Program requirements.

8.0 State Requirements

Any source operating in South Dakota that meets the definition of a major source under the Administrative Rules of South Dakota is required to obtain a Title V air quality permit. A major source is one that has the potential to emit over 100 tons per year of a particular pollutant. Based on potential particulate matter, sulfur dioxide and nitrogen oxide emissions, Basin Electric is considered a major source and required to obtain a Title V air quality permit.

8.1 State Emission Limits

Total suspended particulate and sulfur dioxide emission limits are applicable to fuel burning units. Basin Electric's operations only involve fuel burning units. The total suspended particulate and sulfur dioxide emission limit for fuel burning units is derived from ARSD 74:36:06:02.

The maximum heat input value for Unit #1 and #2 is greater than 10 million Btus per hour. Equation 8.1, derived from ARSD 74:36:06:02(1)(b), is used to calculate the state's total suspended particulate emission limit for fuel burning units with a heat input capacity greater than 10 million Btus per hour.

Equation 8.1 – State total suspended particulate emission limit

$$E_{TSP} \frac{lbs}{MMBtu} = 0.811 \times H^{-0.131}$$

Where: E = the allowable particulate emission rate in pounds per million Btus of heat input

H = the heat input capacity, in units of million Btus per hour

Using Equation 8.1 and the maximum heat input value of Unit #1 and Unit #2 (830 million Btus per hour), the total suspended particulate emission limit for Unit #1 and Unit #2 is 0.3 pounds per million Btus heat input.

In accordance with ARSD 74:36:06:02(2), the sulfur dioxide emission limit for a fuel burning unit is 3.0 pounds per million Btus heat input.

Tables #8-1 and #8-2 compare the applicable state total suspended particulate and sulfur dioxide limits with the potential total suspended particulate and sulfur dioxide emission rates for Unit #1 and Unit #2, respectively.

Table #8-1: Total Suspended Particulate Limit Comparison

Description	Total Suspended Particulate ¹	
	Potential Emission Rate	Emission Limit
Unit #1	0.044 pounds/MMBtus	0.3 pounds/MMBtus
Unit #2	0.044 pounds/MMBtus	0.3 pounds/MMBtus

¹ – Potential emission rate and limit based on heat input.

Table #8-2: Sulfur Dioxide Limit Comparison

Description	Sulfur Dioxide ¹	
	Potential Emission Rate	Emission Limit
Unit #1	0.404 pounds/MMBtus	3.0 pounds/MMBtus
Unit #2	0.404 pounds/MMBtus	3.0 pounds/MMBtus

¹ – Potential emission rate and limit based on heat input.

In addition to the total suspended particulate and sulfur dioxide emission limit, Unit #1 and #2 are also required to meet an opacity limit of 20 percent in accordance with ARSD 74:36:12:01. Based on historical data from inspections at Basin Electric's operations, Unit #1 and #2 are capable of meeting the opacity limit.

Based on the comparison in Table #8-1 and #8-2 in the use of No. 2 distillate fuel oil, Basin Electric is capable of operating in compliance with the state air emission limits.

8.2 Compliance Assurance Monitoring

Compliance assurance monitoring is applicable to permit applications received on or after April 20, 1998 from major sources applying for a Title V air quality permit. Basin Electric's application was received after April 20, 1998; therefore, compliance assurance monitoring is applicable to any unit that meets the following criteria:

1. The unit is subject to an emission limit or standard for the applicable regulated air pollutant;
2. The unit uses a control device to achieve compliance with any such emission limit or standard; and,
3. The unit has potential uncontrolled emissions of the applicable regulated air pollutant that are equal to or greater than 100 percent of the amount, in tons per year, required for a source to be classified as a major source.

Basin Electric does not operate any units meeting all of the above criteria. Therefore, compliance assurance monitoring is not applicable.

8.3 Periodic Monitoring

Periodic monitoring is required for each emission unit that is subject to an applicable requirement at a source subject to Title V of the federal Clean Air Act. The combustion turbines are subject to opacity, particulate, and sulfur dioxide emission limits.

Compliance with the opacity and particulate emission limits will be based on periodic visible emission readings. Basin Electric's Spirit Mound combustion turbine station is operated only during peak or emergency conditions. Basin Electric's combustion turbines have operated less than 100 hours per year over the last five years. The Department's inspections and review of Basin Electric's visible emission observations have noted emissions less than 5% opacity. Therefore, Basin Electric will only be required to conduct a visible emission observation once per year. Based on the infrequent operations, the actual emission rate is less than 20% of the standard, and the opacity observations being less than 5%, particulate testing will not be required.

Compliance with the sulfur dioxide emission limits will be based on the sulfur content of the distillate oil. If a fuel supplier's certificate is not obtained, the facility will be required to test the sulfur content of the distillate oil in the storage tank after each shipment has been unloaded.

9.0 Summary of Applicable Requirements

Based on the above findings, Basin Electric is a major source under the Title V air quality permit program. A major source is one that has the potential to emit over 100 tons per year of a particular pollutant. Basin Electric will be required to operate within the requirements stipulated in the following regulations:

- ARSD 74:36:05 – Operating Permits for Part 70 Sources,

- ARSD 74:36:08 – Maximum Achievable Control Technology Standards;
- ARSD 74:36:11 – Performance Testing;
- ARSD 74:36:12 – Control of Visible Emissions; and,
- ARSD 74:37:01 – Air Pollution Control Program Fees.

10.0 RECOMMENDATION

Based on information DENR received in the permit application, this Title V air quality permit may be renewed. Any questions on this review should be directed to Jill Riedel, Engineer, Department of Environment and Natural Resources.